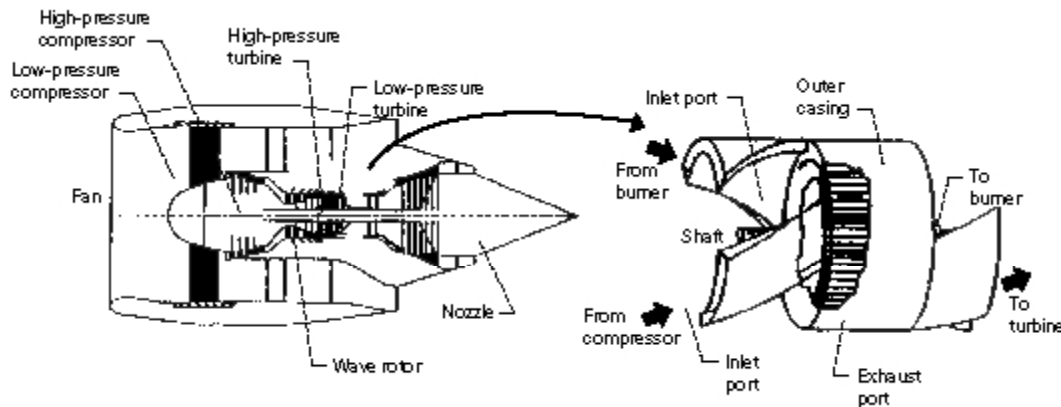


COMETBOARDS Can Optimize the Performance of a Wave-Rotor-Topped Gas Turbine Engine

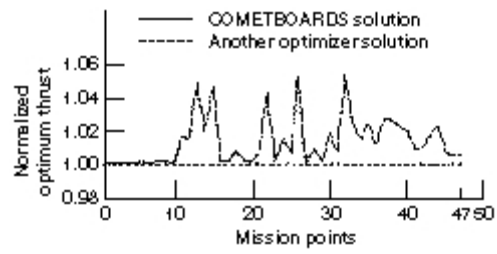
A wave rotor, which acts as a high-technology topping spool in gas turbine engines, can increase the effective pressure ratio as well as the turbine inlet temperature in such engines. The wave rotor topping, in other words, may significantly enhance engine performance by increasing shaft horse power while reducing specific fuel consumption. This performance enhancement requires optimum selection of the wave rotor's adjustable parameters for speed, surge margin, and temperature constraints specified on different engine components. To examine the benefit of the wave rotor concept in engine design, researchers soft coupled NASA Lewis Research Center's multidisciplinary optimization tool COMETBOARDS and the NASA Engine Performance Program (NEPP) analyzer.



Subsonic gas turbine engine.

The COMETBOARDS-NEPP combined design tool has been successfully used to optimize wave-rotor-topped engines. For illustration, the design of a subsonic gas turbine wave-rotor-enhanced engine with four ports for 47 mission points (which are specified by Mach number, altitude, and power-setting combinations) is considered. The engine performance analysis, constraints, and objective formulations were carried out through NEPP, and COMETBOARDS was used for the design optimization. So that the benefits that accrue from wave rotor enhancement could be examined, most baseline variables and constraints were declared to be passive, whereas important parameters directly associated with the wave rotor were considered to be active for the design optimization. The engine thrust was considered as the merit function. The wave rotor engine design, which became a sequence of 47 optimization subproblems, was solved successfully by using a cascade strategy available in COMETBOARDS. The graph depicts the optimum COMETBOARDS solutions for the 47 mission points, which were normalized with respect to standard results. As shown, the combined tool produced higher thrust for all mission points than did the other solution, with maximum benefits around mission points 11, 25, and 31. Such improvements can become critical, especially when engines are sized

for these specific mission points.



COMETBOARDS solution.

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